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**CLINICAL AND METHODOLOGICAL FRAMEWORK FOR EARLY CARIES
DIAGNOSIS AND INDIVIDUALIZED PREVENTION IN CHILDREN WITH DIABETIC
POLYNEUROPATHY**



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ABSTRACT

This methodological article presents an integrated protocol for detecting noncavitated carious lesions and tailoring preventive care in children with diabetic polyneuropathy. The prospective controlled comprised 130 children aged 7-15 years who were examined in Bukhara between 2022 and 2026: 85 children with dental caries in the setting of diabetic polyneuropathy and 45 age-comparable healthy controls. The diagnostic battery combined DMFT/DMFS, OHI-S and ICDAS II with 655-nm laser fluorescence, 2% methylene blue lesion indication, and a structured assessment of salivary flow, pH, viscosity, buffering, calcium-phosphate balance, enzyme activity, oxidative stress markers, cariogenic microorganisms and secretory IgA. The clinical cohort was divided into a conventional subgroup receiving fluoride varnish (n=40) and a multidisciplinary subgroup receiving professional hygiene, lesion-directed indication, dietary and hygiene counselling, and a targeted remineralizing gel protocol (n=45). Follow-up was scheduled at 3, 6 and 12 months. The framework moves clinical decision-making from late cavitation-based diagnosis toward lesion staging, biological risk assessment and individualized non-operative management.

Keywords: diabetic polyneuropathy, children, dental caries, ICDAS II, laser fluorescence, saliva, remineralization, prevention

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**“DIABETIK POLINEYROPATIIYASI MAVJUD BOLALARDA KARIIESNI ERTA
TASHXISLASH VA INDIVIDUAL PROFILAKTIKA QILISHNING KLINIK-USLUBIY
ASOSLARI”**

ANNOTATSIYA

Mazkur uslubiy maqolada diabetik polineyropatiasini mavjud bolalarda tish kariesining kovak hosil bo'lishidan oldingi bosqichlarini aniqlash va profilaktik yordamni individuallashtirishga qaratilgan kompleks protokol bayon etilgan. 2022-2026-yillarda Buxoro shahrida o'tkazilgan nazoratli prospektiv tadqiqotiga 7-15 yoshdagi 130 nafar bola jalb qilingan: asosiy guruhni diabetik



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polineypatiya fonida tish kariesi mavjud 85 nafar bola, nazorat guruhini esa shu yoshdagi 45 nafar sog'lom bola tashkil etgan. Tekshiruv majmuasiga KPO/KPO (yuzalar), OHI-S va ICDAS II indeksleri, 655 nm to'liq uzunligidagi lazer-fluorestsent diagnostika, 2% li metilen ko'ki bilan indikatsiya hamda og'iz suyuqligining fizik-kimyoviy, biokimyoviy, mikrobiologik va immunologik ko'rsatkichlari kiritilgan. Asosiy guruh standart ftorlak qo'llangan 1-A kichik guruh (n=40) va zamonaviy multidissiplinar profilaktika protokoli qo'llangan 2-B kichik guruhga (n=45) ajratilgan. Natijalarni 3, 6 va 12 oyda kuzatish rejalashtirilgan. Taklif etilgan yondashuv kariesni faqat kovak yuzaga kelgandan keyin aniqlash bilan cheklanmay, o'choq bosqichi, biologik xavf va konservativ remineralizatsiya imkoniyatlarini birgalikda baholashga asoslanadi.

Kalit so'zlar: diabetik polineypatiya, bolalar, tish kariesi, ICDAS II, lazer fluorestsensiyasi, so'lak, remineralizatsiya, profilaktika

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«КЛИНИКО-МЕТОДОЛОГИЧЕСКИЕ ОСНОВЫ РАННЕЙ ДИАГНОСТИКИ КАРИЕСА И ИНДИВИДУАЛЬНОЙ ПРОФИЛАКТИКИ У ДЕТЕЙ С ДИАБЕТИЧЕСКОЙ ПОЛИНЕЙРОПАТИЕЙ»

АННОТАЦИЯ

В методической статье представлен комплексный протокол выявления докавитационных кариозных поражений и индивидуализации профилактической помощи детям с диабетической полинейропатией. В контролируемое проспективное исследование, проведенное в Бухаре в 2022-2026 гг., включены 130 детей в возрасте 7-15 лет: 85 детей с кариесом зубов на фоне диабетической полинейропатии и 45 сопоставимых по возрасту здоровых детей контрольной группы. Диагностический комплекс объединил индексы КПУ/КПУ поверхностей, OHI-S и ICDAS II, лазерно-флуоресцентное исследование при длине волны 655 нм, индикацию очагов 2% раствором метиленового синего, а также оценку скорости слюноотделения, pH, вязкости, буферной ёмкости, кальций-фосфорного обмена, ферментативной активности, показателей окислительного стресса, кариесогенной микрофлоры и секреторного IgA. Клиническая когорта разделена на подгруппу стандартной фторпрофилактики (n=40) и подгруппу мультидисциплинарной профилактики с профессиональной гигиеной, индикацией поражений, коррекцией питания и гигиены и курсом реминерализующего геля (n=45). Контрольные обследования предусмотрены через 3, 6 и 12 месяцев. Предложенная схема переносит акцент с позднего выявления полости на стадирование поражения, оценку биологического риска и индивидуальное неоперативное ведение.

Ключевые слова: диабетическая полинейропатия, дети, кариес зубов, ICDAS II, лазерная флуоресценция, слюна, реминерализация, профилактика

Dental caries in a child with diabetes should not be regarded as a simple consequence of elevated blood glucose. It develops within a biological and behavioural system in which plaque exposure, diet, fluoride availability, saliva, daily self-care and metabolic control interact. This matters clinically because children with the same diagnosis of diabetes may show very different caries profiles. Some are closely monitored, follow a sugar-conscious diet and maintain good oral hygiene; others experience unstable glycaemia, reduced salivary protection and irregular dental attendance. A useful diagnostic strategy must therefore capture both the lesion that is already present and the conditions that allow the lesion to progress [1-3].



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Published findings support this more careful interpretation. A 2019 meta-analysis estimated a pooled caries prevalence of 67% among children and adolescents with type 1 diabetes and reported a mean DMFT of 5.7, although the included studies were heterogeneous [4]. A later systematic review and meta-analysis found that the decisive issue was often the quality of metabolic control rather than diabetes alone: children with poor glycaemic control had higher DMFT values than non-diabetic controls, whereas well-controlled children had comparable values [5]. The practical implication is clear. A child with diabetic polyneuropathy should be considered medically vulnerable, but dental risk still needs to be measured rather than assumed.

Saliva is central to that assessment. It clears fermentable substrates, buffers acids and supplies calcium and phosphate for post-eruptive enamel maturation. Diabetes-associated changes in flow rate and composition have been described in children, but the direction and magnitude of individual markers are not uniform across studies [6-8]. This variability argues against using a single salivary value as a diagnostic verdict. Salivary findings are more informative when interpreted alongside lesion staging, plaque status, diet, glycaemic history and longitudinal change.

Contemporary caries management also requires recognition of disease before cavitation. The ICDAS/ICCMS framework places visual lesion severity and activity within a preventive decision pathway and makes it possible to record early enamel changes that the conventional decayed-missing-filled count may overlook [9]. Laser fluorescence can add quantitative information, particularly in pits and fissures, although it is best used as an adjunct rather than a substitute for a clean, dry visual examination [10,11]. The present study was designed around this layered logic: standard epidemiological measures establish disease experience, ICDAS II stages current lesions, optical and dye-based methods refine detection, and saliva testing characterizes the oral environment.

Aim of the research. To develop a clinically practical framework for the early, non-invasive detection of dental caries in children with diabetic polyneuropathy and to individualize preventive and remineralizing care according to lesion stage and biological risk.

Research tasks:

1. to determine the prevalence, intensity and principal risk factors of early dental caries in children with diabetic polyneuropathy;
2. to compare ICDAS II and laser fluorescence with conventional clinical examination and refine the combined diagnostic criteria;
3. to develop an early caries-risk assessment model based on the physical, chemical, biochemical and microbiological characteristics of oral fluid;
4. to formulate an individualized remineralization and prevention programme and define the clinical and laboratory indicators for its follow-up.

Material and methods. The research was carried out at the dental clinical base of Bukhara State Medical Institute from 2022 to 2026. It was planned as an observational, controlled, non-randomized, prospective cohort study. The source population consisted of children registered for follow-up at urban and district outpatient clinics in Bukhara. In total, 130 children aged 7-15 years were enrolled. The clinical cohort included 85 children with dental caries in the setting of diabetic polyneuropathy (39 boys and 46 girls). The control cohort included 45 age-comparable healthy children (20 boys and 25 girls). The age range and core oral examination procedures followed the principles of the World Health Organization oral health survey methodology [1]. Parents or legal representatives received written and verbal information about the study and provided informed consent for clinical and laboratory procedures.



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Table 1. Study cohort and preventive pathways

Group	n	Clinical profile	Diagnostic and preventive pathway
Control	45	Healthy children aged 7-15 years	Standardized clinical, index and laboratory comparison
Clinical cohort	85	Dental caries with diabetic polyneuropathy	Full diagnostic battery; divided into two preventive subgroups
Subgroup 1-A	40	Conventional protocol	Professional cleaning and fluoride varnish applications
Subgroup 2-B	45	Multidisciplinary protocol	Lesion indication, professional hygiene, counselling and remineralizing gel

Eligibility. Children were included when their age was within the stated range, written informed consent had been obtained, and the family was prepared to follow the dentist's recommendations. Exclusion criteria were an age outside the study range, a recent surgical procedure, immunodeficiency, autoimmune disease or oncological disease. Participants could be withdrawn at any stage at their own or their representative's request; newly identified somatic conditions that made further participation inappropriate were also grounds for withdrawal.

Clinical examination. The dentition was examined in a fixed sequence under standardized conditions. Caries experience was recorded using DMFT for permanent teeth and DMFS for affected surfaces, with separate counts of decayed, missing and filled components. Annual increments were intended to reflect newly affected teeth or surfaces during follow-up. Oral hygiene was assessed with the Simplified Oral Hygiene Index (OHI-S), comprising debris and calculus components. In the working protocol, scores of 0-0.6 were interpreted as good hygiene, 0.7-1.6 as satisfactory, 1.7-2.5 as unsatisfactory and values above 2.6 as poor hygiene.

Lesion staging with ICDAS II. After professional cleaning, each surface was first viewed wet and then dried with air for five seconds. ICDAS code 0 indicated a sound surface; code 1 a first visual change visible only after prolonged drying; code 2 a distinct visual change visible when wet; code 3 localized enamel breakdown without visible dentine; code 4 an underlying dark dentinal shadow; code 5 a distinct cavity with visible dentine involving less than half of the surface; and code 6 an extensive cavity involving at least half of the surface. Recording the earliest codes was particularly important because these lesions remain candidates for non-operative care. Developmental defects were differentiated by their history, symmetry, location and surface characteristics rather than being automatically classified as caries.

Laser-fluorescence assessment. A DIAGNOdent device was used as an adjunctive optical method. The instrument emits red light at a wavelength of 655 nm and expresses the returned fluorescence signal on a numerical scale. Surfaces were cleaned, isolated, dried and scanned according to the same sequence at each visit. Values of 0-13 were treated as compatible with sound enamel, 14-24 as an early enamel-level change, and 25 or higher as suggestive of dentinal involvement within the study protocol. The reading was never interpreted in isolation: plaque, calculus, stains and residual restorative materials can increase fluorescence and produce misleading values. Agreement with ICDAS II and the clinical context was therefore required before a treatment decision was made [10,11].

Oral-fluid sampling. Samples were collected between 08:00 and 11:00 under standardized pre-analytical conditions. Children were instructed not to eat, drink, brush their teeth or rinse their mouth for at least two hours before collection. For unstimulated saliva, the child sat comfortably with the head slightly lowered and expectorated accumulated saliva into a sterile graduated tube at one-minute intervals for 5-10 minutes. When stimulated saliva was required, chewing paraffin or a



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controlled citric-acid stimulus was used for five minutes. Flow rate was calculated by dividing the collected volume by collection time.

Immediate chairside measurements included pH, viscosity and acid/alkali buffering. Samples were then centrifuged at 3000 rpm for 10-15 minutes. The supernatant was reserved for biochemical analysis and the sediment for microbiological or microscopic assessment; aliquots intended for delayed analysis were stored frozen. The biochemical panel included ionized calcium, inorganic phosphorus, the Ca/P ratio, alkaline and acid phosphatases, malondialdehyde, superoxide dismutase and catalase. Microbiological culture quantified *Streptococcus mutans* and *Lactobacillus* as colony-forming units per millilitre, while secretory IgA was measured by immunoassay. This broad panel was selected because salivary biomarkers may contribute to risk stratification, but current evidence does not support replacing clinical diagnosis with a single marker [7,8,12,13].

Methylene-blue indication. A 2% aqueous methylene-blue solution was used to visualize porous demineralized tissue. After plaque removal, isolation and drying for 10-15 seconds, the solution was applied with a microbrush or cotton pellet for 60-90 seconds, rinsed thoroughly and the surface was dried again. Absence of staining was interpreted as a dense or successfully remineralized surface; light-blue uptake suggested early demineralization suitable for conservative management; intense staining suggested deeper tissue alteration requiring careful clinical reassessment. Because the dye is an indicator rather than an independent reference standard, its interpretation was integrated with ICDAS II and optical findings.

Preventive protocols. The 85 children in the clinical cohort were assigned to two real-world treatment pathways. Subgroup 1-A (n=40) received the conventional protocol. Teeth were professionally cleaned, isolated and dried, after which a thin layer of fluoride varnish was applied to demineralized areas and fissures. The application was repeated three times at intervals of 3-4 days. Children and caregivers received post-application instructions intended to preserve the varnish film.

Subgroup 2-B (n=45) received a multidisciplinary protocol. It combined professional biofilm removal, methylene-blue lesion indication, minimally invasive management only where tissue breakdown required it, individualized dietary and hygiene counselling, and a course of Asepta Minerals remineralizing gel. The gel was delivered either in a vacuum-formed tray (1.5-2.0 mL for 15-20 minutes), directly to isolated white-spot areas with a microbrush or cotton pellet (20-30 minutes), or at home after evening oral hygiene according to the child's age and ability to cooperate. The planned course lasted 14-21 days; children were instructed not to eat or drink for 40 minutes after application. The protocol evaluates the product as part of a combined care pathway and does not assume that one component alone accounts for any later change.

Follow-up and statistical analysis. Methylene-blue indication was scheduled for reassessment after three months. DMFT/DMFS, ICDAS II, oral-fluid pH and other selected clinical-laboratory variables were reassessed at six and twelve months. Data were organized in Microsoft Excel 2010 and analysed in IBM SPSS Statistics version 23. Quantitative variables were checked for distributional assumptions using the Kolmogorov-Smirnov test together with skewness and kurtosis. Normally distributed data were summarized as mean, standard deviation, standard error and 95% confidence interval; Student's t-test was planned for appropriate mean comparisons. Categorical observations were reported as absolute numbers and percentages. Statistical significance was set at $p < 0.05$, with non-parametric methods reserved for variables that did not meet parametric assumptions.

Discussion. The strength of the proposed framework lies in the way its parts answer different clinical questions. DMFT and DMFS show cumulative disease experience but are relatively insensitive to the earliest enamel changes. ICDAS II records the lesion continuum and supports decisions about non-operative care. Laser fluorescence adds a reproducible numerical signal that can be followed over time, while the saliva panel describes the biological environment in which demineralization and remineralization occur. Methylene-blue indication offers a simple visual aid



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where advanced optical equipment is not available. None of these methods is sufficient alone; their value comes from concordant interpretation.

This combination is especially relevant in children with diabetes because published estimates of caries burden are not uniform. Differences in metabolic control, diet, oral hygiene, salivary function, age and access to preventive care can move risk in opposite directions [3-8]. The clinical label therefore identifies a child who deserves closer attention, but it does not replace individualized assessment. In practice, a child with low salivary flow, poor plaque control and active ICDAS 1-2 lesions requires a different recall schedule and preventive intensity from a child with stable glycaemia, good hygiene and inactive lesions.

The intervention also follows the modern preference for preserving tooth structure. Current paediatric guidance supports risk-based surveillance, fluoride exposure, dietary counselling, sealants and non-restorative care for appropriate noncavitated lesions [14]. In the present protocol, the conventional fluoride-varnish pathway provides a clinically recognizable comparison, while the multidisciplinary pathway tests whether lesion visualization, intensive hygiene control and targeted remineralization can be delivered as one coherent programme. Because allocation is non-randomized, future outcome reporting should document baseline comparability and interpret between-group differences as comparative effectiveness in routine practice rather than as definitive proof of causality.

A further advantage is the planned duration of observation. A short-term reduction in staining or plaque does not necessarily mean durable caries control. The three-month visit captures early response and adherence, whereas the six- and twelve-month assessments can show whether lesion activity, new caries increments and salivary conditions remain stable. This longitudinal perspective is essential in diabetic polyneuropathy, where the systemic disease is chronic and preventive needs may change with metabolic status.

Conclusions. The study protocol provides a structured way to investigate early caries in children with diabetic polyneuropathy without relying on cavitation alone. Its central clinical principle is the joint interpretation of lesion severity, oral hygiene, salivary protection, microbiological load and the child's systemic context. ICDAS II remains the foundation of visual staging; laser fluorescence and methylene-blue indication serve as adjuncts, while oral-fluid analysis supports biological risk assessment. The comparison of a conventional fluoride-varnish pathway with a multidisciplinary remineralizing pathway, followed for up to twelve months, creates a methodologically sound basis for evaluating clinically meaningful change. Final claims of superiority, however, should be based on the measured follow-up outcomes rather than on the protocol itself.

References

1. World Health Organization. Oral Health Surveys: Basic Methods. 5th ed. Geneva: World Health Organization; 2013. ISBN 978-92-4-154864-9.
2. Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, et al. Dental caries. Nat Rev Dis Primers. 2017;3:17030. doi:10.1038/nrdp.2017.30.
3. Ismail AF, McGrath CP, Yiu CKY. Oral health of children with type 1 diabetes mellitus: a systematic review. Diabetes Res Clin Pract. 2015;108(3):369-381. doi:10.1016/j.diabres.2015.03.003.
4. Wang Y, Xing L, Yu H, Zhao L. Prevalence of dental caries in children and adolescents with type 1 diabetes: a systematic review and meta-analysis. BMC Oral Health. 2019;19:213. doi:10.1186/s12903-019-0903-5.
5. Triebl Z, Bencze B, Banyai D, Rozsa N, Hermann P, Vegh D. Poor glycemic control impairs oral health in children with type 1 diabetes mellitus: a systematic review and meta-analysis. BMC Oral Health. 2024;24:748. doi:10.1186/s12903-024-04516-y.
6. Ferizi L, Dragidella F, Spahiu L, Begzati A, Kotori V. The influence of type 1 diabetes mellitus on dental caries and salivary composition. Int J Dent. 2018;2018:5780916. doi:10.1155/2018/5780916.
7. Pappa E, Vastardis H, Rahiotis C. Chair-side saliva diagnostic tests: an evaluation tool for xerostomia and caries risk assessment in children with type 1 diabetes. J Dent. 2020;93:103224. doi:10.1016/j.jdent.2019.103224.



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8. Ferizi L, Bimbashi V, Kelmendi J. Association between metabolic control and oral health in children with type 1 diabetes mellitus. BMC Oral Health. 2022;22:502. doi:10.1186/s12903-022-02555-x.
9. Pitts NB, Ekstrand KR; ICDAS Foundation. International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS): methods for staging of the caries process and enabling dentists to manage caries. Community Dent Oral Epidemiol. 2013;41(1):e41-e52. doi:10.1111/cdoe.12025.
10. Monea M, Esian D, Vlad RE, Bica CI. In vivo effectiveness of visual inspection and laser fluorescence in the diagnosis of early pit-and-fissure carious lesions: a cross-sectional study in a group of Romanian children. Medicine (Baltimore). 2021;100(45):e27811. doi:10.1097/MD.00000000000027811.
11. Du Y, Yang Y, Liu Y, et al. Evaluation of DIAGNOdent pen for initial occlusal caries diagnosis in permanent teeth. BMC Oral Health. 2024;24:1111. doi:10.1186/s12903-024-04889-0.
12. Alamoudi A, Alamoudi R, Gazzaz Y, Alqahtani AM. Role of salivary biomarkers in diagnosis and detection of dental caries: a systematic review. Diagnostics (Basel). 2022;12(12):3080. doi:10.3390/diagnostics12123080.
13. Ahmad P, Hussain A, Carrasco-Labra A, Siqueira WL. Salivary proteins as dental caries biomarkers: a systematic review. Caries Res. 2022;56(4):385-398. doi:10.1159/000526942.
14. American Academy of Pediatric Dentistry. Caries-risk assessment and management for infants, children, and adolescents. In: The Reference Manual of Pediatric Dentistry. Chicago: AAPD; 2025:325-331.